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ABSTRACT

Employment opportunities for physics and astronomy graduates were surveyed in December 1977. At that time the graduates of 1976-77 had explored the job market for at least six months or had held their positions long enough to evaluate them and offer advice to prospective graduates. The time required for new graduates to obtain the first post-degree position is reported. The employment status 6-18 months after graduation of degree recipients at the doctoral, masters, and bachelors levels is provided separately for physics and astronomy majors. Data are presented on the following characteristics of graduates: age, citizenship, type of research, and major subfields. A breakdown is presented of characteristics of graduates and the time required to secure employment. Types of employers, subfields and work activity, and factors influencing the length of postdoctoral fellowships are covered for Ph.D. level physicists. (SW)

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EMPLOYMENT SURVEY 1977

by Susanne D. Ellis

AIP Pub. No. R-282.1 July 1978

The Employment Survey is a relative newcomer among the annual AIP surveys. It serves as a follow-up study which reexamines the employment opportunities for physics and astronomy graduates. The present Survey was conducted in December 1977, a time when the degree recipients of 1976-77, whose post-degree plans were employment, had a minimum of six months to explore the job market; or, as many respondents indicate, they have held their positions long enough to evaluate them and offer advice to prospective graduates. Until 1976 highlights of the Employment Survey results were included in the reports of the Survey of Physics Bachelor's Degree Recipients and the Graduate Student Survey.

This is the second time that the Employment Survey is published as a separate report; therefore comparisons of its findings with those of the previous year may be informative.

The statistical information presented in this report includes many details of the types of employment as well as characteristics of the physics-degree recipients; but one of the most important questions this survey answers, is: How much time does a new graduate require to obtain his or her first post-degree employment.

Figure I supplies the answer to that question for each of the three levels of degree recipients. Only those who accepted potentially permanent positions are included among the doctoral graduates; postdoctoral fellows had a relatively easy task to secure one- or two-year fellowships in their subfields and are consequently excluded from the bar graphs of **Figure I.** Thus the bachelors are the group with the highest proportion of job seekers who accepted employment within one month of starting an active search—56% of them. Masters followed with 43% and only 37% of the doctorate recipients were able to secure potentially permanent positions within one month.

Later in the report **Tables V-VIII** elaborate on the kinds of employment that graduates secured and what factors were influential in obtaining positions in a short time. Masters included the only graduates who spent more than one year before finding employment.

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Fig. I Time spent by 1976-77 physics-degree recipients in securing employment

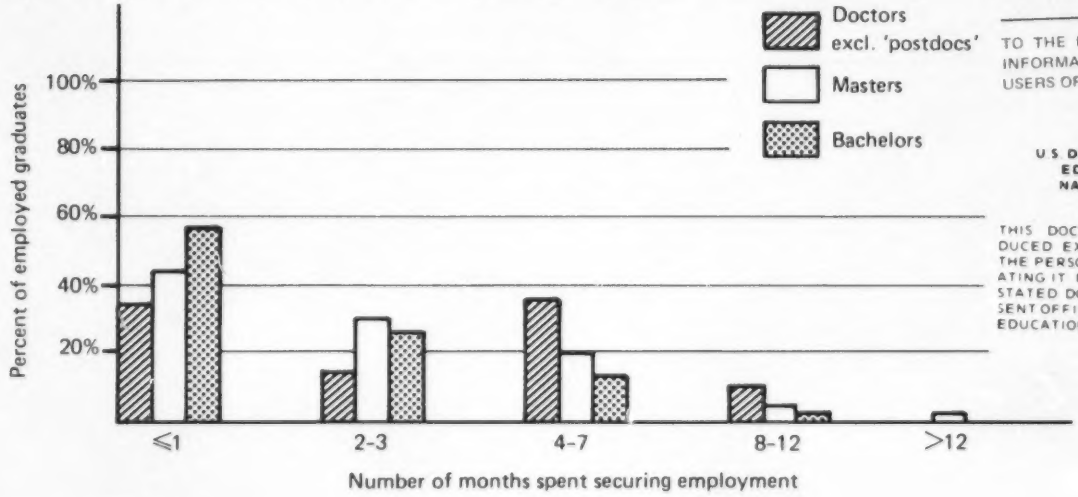

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Table I. Employment status of 1976–77 physics and astronomy degree recipients, 6–18 months after graduation.

	Graduates 1976–77		Employment status: 'Postdocs'		Full-time employment		Other (incl. part-t. temp., vol.)		Student		Unemployed and seeking		Total N	%
Physics	Doctors	Men	172	47%	189	51%	–		–		8	2%	369	100%
		Women	10		8		–		–		–		18	
	Masters	Men	–		140	73%	13	7%	29	16%	7	4%	189	100%
		Women	–		11		2		3		1		17	
	Bachelors	Men	–		543	86%	45	8%	18	3%	20	3%	626	100%
		Women	–		70		9		2		3		84	
	Total physics	N	182		961		69		52		39		1303	
		%	14		74		5		4		3			100%
Astronomy	Doctors	Men	18	55%	16	43%	–		–		1	2%	35	100%
		Women	4		1		–		–		–		5	
	Masters	Men	–		4	86%	1	14%	–		–		5	100%
		Women	–		2		–		–		–		2	
	Bachelors	Men	–		23	73%	4	13%	–	3%	4	11%	31	100%
		Women	–		4		1		1		–		6	
	Total astronomy	N	22		50		6		1		5		84	
		%	26		60		7		1		6			100%
	Total in survey	N	204		1011		75		53		44		1387	
		%	15		73		5		4		3			100%

Table I presents the employment status of all the respondents, both physics and astronomy and at all three degree levels, bachelor's, master's, and doctor's. The decreasing number of physics degrees granted annually in recent years partly accounts for the 13 percentage-point fewer respondents to this survey than in the previous year; however, the overall response rate continues to be above 70%. Nevertheless the most important aspect of **Table I** is shown by the column headed "Unemployed and seeking" which indicates a lower rate of unemployment for each of the subgroups than the year before. In particular, 3% and 6% for uncommitted physics and uncommitted astronomy graduates respectively, compare with 6% and 8% in the previous survey.

Under the column headed "Student" there are 32 physics masters and 20 physics bachelors shown in **Table I** who were seeking employment during the summer of 1977 but changed their plans and returned to, or started graduate school instead.

Table II singles out the employed doctorate recipients among the physicists and astronomers, and presents four characteristics for each group. These employed scientists are sub-divided into those holding postdoctoral fellowships and those engaged in regular full-time employment. In comparing the groups of physicists and astronomers one should keep in mind that the ratio of respondents is almost ten to one; the absolute number of astronomers is quite small. Thus, the fact that astronomy 'postdocs' have the highest percentage of foreign citizens could be attributed to the small number of respondents, namely 22. Similarly, the higher median age of doctoral physicists than doctoral astronomers may again be attributable to the small number of astronomers.

Tables III and **IV** present background characteristics of masters and bachelors respectively and relate them to the employment status as reported by those new degree recipients during the winter of 1977–78. It appears that none of the characteristics listed in those tables have an impact on actively securing employment; however, later tables will indicate that these characteristics do affect the length of time spent finding employment. The data in **Table III** confirm the finding that employers tend to prefer experimentalists over theoreticians. Yet it should be noted that the ratio of experimentalists to theoreticians is 2:1.

TABLE XI (continued)

Honors Received

OTHERS (Who's Who, . . .)	VA N (%)	A N (%)	VA+A N (%)	MA N (%)	I N (%)	Total N (%)
Number of persons mentioning e	2(20)	1(11)	3(16)	2 (8)	4(10)	9(12)
Number of mentions	2(14)	1 (4)	3 (8)	3(27)	5(50)	11(19)
Number of *'s	0 (0)	0 (0)	0 (0)	0 (0)	3(100)	3(23)
			Grand Totals			
Number of persons mentioning e	6(60)	8(89)	14(74)	9(38)	8(26)	31(42)
Number of mentions	14(16)	24(26)	38(21)	11 (5)	10 (4)	59 (9)
Number of *'s	0 (0)	7(32)	7(15)	3 (5)	3 (4)	13 (7)

TABLE XII

Retirement and Afterwards

	VA N (%)	A N (%)	VA+A N (%)	MA N (%)	I N (%)	Total N (%)
RETIREMENT						
Unqualified						
Number of persons mentioning e	2(20)	4(44)	6(32)	11(46)	23(56)	40(54)
Number of mentions	2(29)	4(67)	6(46)	11(65)	25(78)	42(68)
Number of *'s	0 (0)	0 (0)	0 (0)	1(100)	3(75)	4(67)
CONTINUED CU WORK						
Emeritus						
Number of persons mentioning e	1(10)	0 (0)	1 (5)	3(12)	1 (2)	5 (7)
Number of mentions	1(14)	0 (0)	1 (8)	3(18)	1 (3)	5 (8)
Number of *'s	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
At Different University						
Number of persons mentioning e	4(40)	0 (0)	4(21)	1 (4)	0 (0)	5 (7)
Number of mentions	4(57)	0 (0)	4(31)	1 (6)	0 (0)	5 (8)
Number of *'s	1(100)	0 (0)	1(100)	0 (0)	0 (0)	1(17)
Total on Continued University Work						
Number of persons mentioning e	5(50)	0 (0)	5(26)	4(17)	1 (3)	10(14)
Number of mentions	5(71)	0 (0)	5(38)	4(24)	1 (3)	10(16)
Number of *'s	1(100)	0 (0)	1(100)	0 (0)	0 (0)	1(17)
RESEARCH AND CONSULTING						
Number of persons mentioning e	0 (0)	1(11)	1 (5)	2 (8)	2 (5)	5 (7)
Number of mentions	0 (0)	1(17)	1 (8)	2(12)	2 (6)	5 (8)
Number of *'s	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
OTHER (Administrative work, informal CU contacts)						
Number of persons mentioning e	0 (0)	1(11)	1 (5)	0 (0)	4(10)	5 (7)
Number of mentions	0 (0)	1(17)	1 (8)	0 (0)	4(12)	5 (8)
Number of *'s	0 (0)	0 (0)	0 (0)	0 (0)	1(25)	1(17)
Grand Totals						
Number of persons mentioning e	6(60)	5(56)	11(58)	15(62)	27(87)	53(72)
Number of mentions	7 (8)	6 (7)	13 (7)	17 (7)	32(11)	62 (9)
Number of *'s	1 (4)	0 (0)	1 (2)	1 (2)	4 (7)	6 (3)

Table II. Characteristics of physics and astronomy doctorate recipients, 1976–77

Characteristics	Physics 'Postdocs'	Physics Full-time employed	Astronomy 'Postdocs'	Astronomy Full-time employed	Characteristics
Age:					Age:
26 or younger	2%	1%	18%	6%	26 or younger
27 yrs.	7	4	14	24	27 yrs.
28 yrs.	14	14	9	6	28 yrs.
29 yrs.	16	18	23	29	29 yrs.
30 yrs.	20	12	9	0	30 yrs.
31–32 yrs.	24	21	9	12	31–32 yrs.
33 or older	17	30	18	23	33 or older
Citizenship					Citizenship
U.S.	82%	84%	77%	88%	U.S.
Foreign	18	16	23	12	Foreign
Type of research:					Type of research:
Experimental	57%	56%	50%	47%	Observational
Theoretical	26	29	25	24	Theoretical
Both	17	15	25	29	Both
Major subfields					Major subfields:
Astrophysics	6%	2%	14%	12%	Cosmology, extragalactic, quasi-stellar objects
Elem. particles	19	10	14	24	Interstellar matter and gaseous nebulae
Nuclear	15	13	9	6	Solar system, space astronomy of the solar system
Optics	2	5	36	29	Stellar atmospheres and spectra, stellar evolution, solar and stellar interiors
Plasma	6	6			
Solid state	26	38	27	29	Other
Number of respondents	182	197	22	17	

Table III. Background characteristics and employment status of 1976–77 physics masters

Characteristics		Employment full-time	Employment part-time temporary	Student	Unemployed and seeking	Total	
Citizenship	U.S.	75%	8%	14%	3%		195
	Foreign	45	–	45	10		11
Age	23 or younger	60%	6%	27%	7%		15
	24 yrs.	79	5	14	2		43
	25 yrs.	74	5	18	3		38
	26–28 yrs.	75	3	18	4		56
	29 or older	73	13	8	6		54
Type of institution last attended	Doctorate-granting	70%	8%	19%	3%		140
	Master's-granting	81	5	8	6		66
Type of research	Experimental	76%	7%	14%	3%		93*
	Theoretical	61	11	22	6		37*
Respondents in survey		151	15	32	8		206

* *76 respondents indicated both experimental and theoretical research.*

Note: The seven astronomy masters presented in Table I are U.S. citizens, three of them are age 25 and four fall into the 26–28 age group; six out of the seven astronomers received their master's degrees at PhD-granting institutions, and the type of research they performed in graduate school was observational for two and theoretical for two; four of them specified both types of research.

Table IV. Background characteristics and employment status of 1976–77 physics and astronomy bachelors.

Characteristics	Physics				Total	Astronomy				Total
	Employment full-time	Employment part-time temp. etc.	Student	Unemployed and seeking		Employment full-time	Employment part-time temp. etc.	Student	Unemployed and seeking	
Citizenship										
U.S.	87%	7%	3%	3%	705	72%	14%	3%	11%	37
Foreign	80	20	–	–	5	–	–	–	–	–
Age										
21 or younger	92%	5%	–	3%	36	–	–	–	–	1
22 yrs.	87	7	4%	2	308	100%	–	–	–	14
23 yrs.	80	11	5	4	160	87	13%	–	–	11
24 yrs.	82	4	7	7	56	33	22	12%	33%	5
25 or older	90	6	1	3	150	83	17	–	–	6
Type of bachelor's institution										
Doctorate-granting	83%	10%	3%	4%	293	79%	4%	4%	13%	26
Master's-granting	90	4	3	3	120	60	40	–	–	5
Bachelor's-granting	98	6	3	3	297	50	33	–	17	6
Respondents in survey	613	54	20	23	710	27	5	1	4	37

Although the doctorate-granting institutions produce approximately half of all the physics bachelors, by focusing only on those who seek immediate employment one can see that the 4-year colleges contribute as many physics bachelors to the labor force as the doctorate-granting institutions. **Table IV** illustrates this statistic as its third characteristic. This part of **Table IV** also shows that almost identical proportions of the graduates from the three types of institutions were successful in acquiring employment, namely 93% and 94%.

Table V. Characteristics of 1976–77 physics masters that influence the time required to secure employment

Characteristics		Time spent finding employment ≤ 1 month	2–3 months	4–7 months	8–12 months	> 1 yr.	Total %	N
Sex	Men	41%	31%	20%	4%	4%	100	153
	Women	61	31	8	–	–	100	13
Age	23 or younger	63%	25%	12%	–	–	100	8
	24 yrs.	26	43	26	5%	–	100	36
	25 yrs.	40	27	27	6	–	100	31
	26 yrs.	50	25	13	12	–	100	25
	27–30 yrs.	47	27	20	3	3	100	42
	31 or older	48	30	9	13	–	100	24
Type of graduate institution	Doctorate-granting	39%	32%	22%	6%	1%	100	109
	Master's-granting	48	30	15	7	–	100	57
Type of employment	Physics related	40%	29%	23%	8%	–	100	120
	Unrelated to physics	53	34	9	2	2%	100	46
Major employers	Industry	27%	48%	21%	–	4%	100	89
	College or University	50	15	23	12%	–	100	27
	High school	70	–	20	–	10	100	10
	Government inc. military	65	8	19	4	4	100	27
	Other	67	17	–	16	–	100	13
Total respondents		43%	30%	20%	4%	3%	100%	166

Table VI. Characteristics of 1976–77 physics bachelors that influence the time required to secure employment

Characteristics		Time spent finding employment ≤ 1 month	2–3 months	4–7 months	8–12 months	> 1 yr.	Total %	N
Sex	Men	56%	25%	15%	3%	1%	100	588
	Women	49	35	13	1	2	100	79
Age	21 or younger	57%	29%	14%	–	–	100	35
	22 yrs.	54	26	18	2%	–	100	296
	23 yrs.	48	28	20	3	1%	100	146
	24 yrs.	60	20	10	8	2	100	50
	25–30 yrs.	63	27	4	5	1	100	101
	30 or older	72	18	10	–	–	100	39
Type of bachelor's institution	Doctorate-granting	53%	23%	21%	2%	1%	100	270
	Master's-granting	53	31	11	5	–	100	114
	Bachelor's-granting	59	27	11	3	–	100	283
Type of employment	Physics related	52%	29%	15%	3%	1%	100	376
	Unrelated to physics	60	23	14	3	<1	100	291
Major employers	Industry**	46%	31%	19%	3%	1%	100	386
	College or University	75	22	3	–	–	100	41
	High school	47	30	19	4	–	100	55
	Government*	62	23	9	6	–	100	48
	Military	82	11	7	–	–	100	78
	Other	72	13	10	5	–	100	59
Total respondents		56%	26%	15%	3%	<1%	100%	667

* *Includes 1% of the bachelors who joined the Peace Corps.*

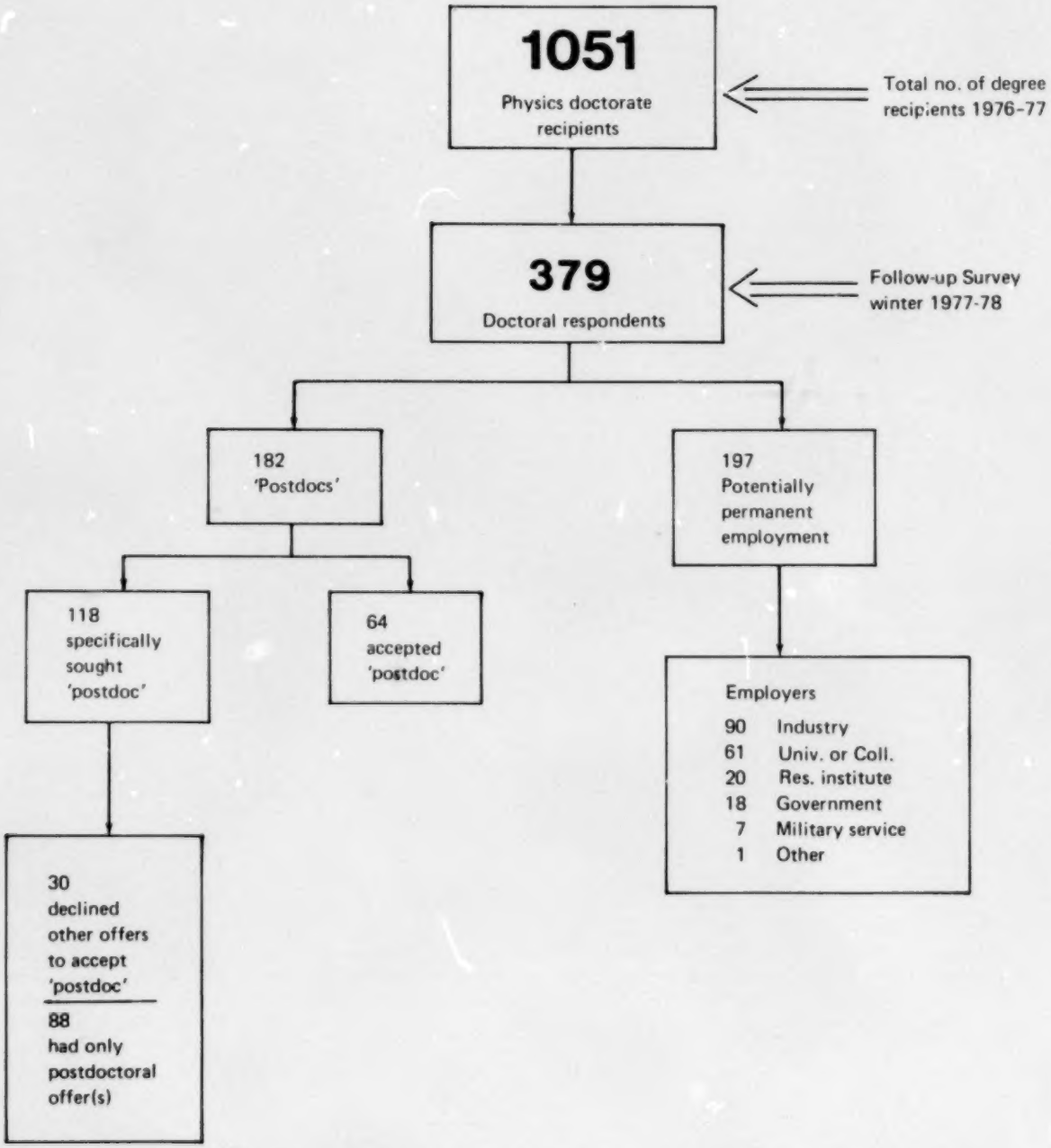
** *Electronics and computer companies were cited by one third of this group of respondents.*

To explore the employment picture in greater detail **Tables V** and **VI** single out the employed physics masters and bachelors and examine different characteristics that determine how quickly employment can be found, and what concessions, if any, can be made. For example, both masters and bachelors appear to spend less time on the search for employment if they are willing to accept positions that do not make use of their physics training. One can conclude from these tables that women masters find positions more readily than women bachelors; 61% of the women masters compared with 49% of the women without graduate training found initial employment immediately.

A college graduate's age appears to influence the amount of time spent locating employment; a higher percentage of older bachelors fall into the "one month or less" category of **Table VI**. Of course one can assume that the age groups of 24 and above include graduates with some work experience.

The major employer of all non-doctoral physics graduates is industry, and among the industrial companies those involved in electronics or computers are cited most frequently. Military service attracts a large number of bachelors but very few of the masters; consequently masters who entered the military service are included with "Government" as an employer in **Table V**.

Fig. II. Employment status of 1976–77 doctoral physicists 6–18 months after graduation



As already shown in **Table I** doctorate recipients are divided into two groups: those who accepted temporary postdoctoral fellowships and those who found potentially permanent positions. Their ratio right after graduation is approximately 2:3, but the latter group is generally more willing to relocate farther and consequently more difficult to contact for a follow-up survey. Thus **Figure II** shows almost a 1:1 ratio of these two groups of doctoral graduates and their post-degree employment status.

A frequent assumption has been the one that a postdoctoral fellowship is a graduate's second choice when he or she is unable to secure potentially permanent employment; only during the early 1970's was this assumption correct. **Figure II** shows that not only did two-thirds of the 'postdocs' specifically seek those temporary positions, but 17% of them turned down offers with potential permanence to accept postdoctoral fellowships. However, there were 197 doctoral graduates who sought and accepted employment with potential permanence; their employers shown in **Figure II** are analyzed in greater detail in **Table VII.**

Table VII. Employment of 1976–77 doctoral level physicists

		Type of Employer						
		Coll./Univ.	Industry	Government (incl. military)	Research institute	Other	Total N	%
Subfield of PhD	Elementary particles	4	10	3	3	–	20	10
	Nuclear	4	11	3	7	–	25	13
	Electron, atomic and molecular	9	6	5	1	1	22	11
	Solid state	24	39	10	4	–	77	39
	Optics	1	8	–	1	–	10	5
	Other	19	16	4	4	–	43	22
Work activity	Research	12	28	14	10	–	64	33
	Teaching and research	22	4	2	4	–	32	16
	Teaching	22	–	1	–	1	24	12
	Res. and dev.	4	27	2	1	–	34	17
	Engr. and dev.	1	20	4	1	–	26	13
	Other	–	11	2	4	–	17	9
Physics related work	Same subfield	34	37	11	9	–	91	46
	Different subfield	18	39	10	10	1	78	40
	Subtotal	52	76	21	19	1	169	86
Work unrelated to physics	Research oriented	7	4	3	–	–	14	7
	New area	2	6	–	–	–	8	4
	Other	–	4	1	1	–	6	3
	Subtotal	9	14	4	1	–	28	14
	Total respondents	61	90	25	20	1	197	
		31%	46%	13%	10%	–		100%

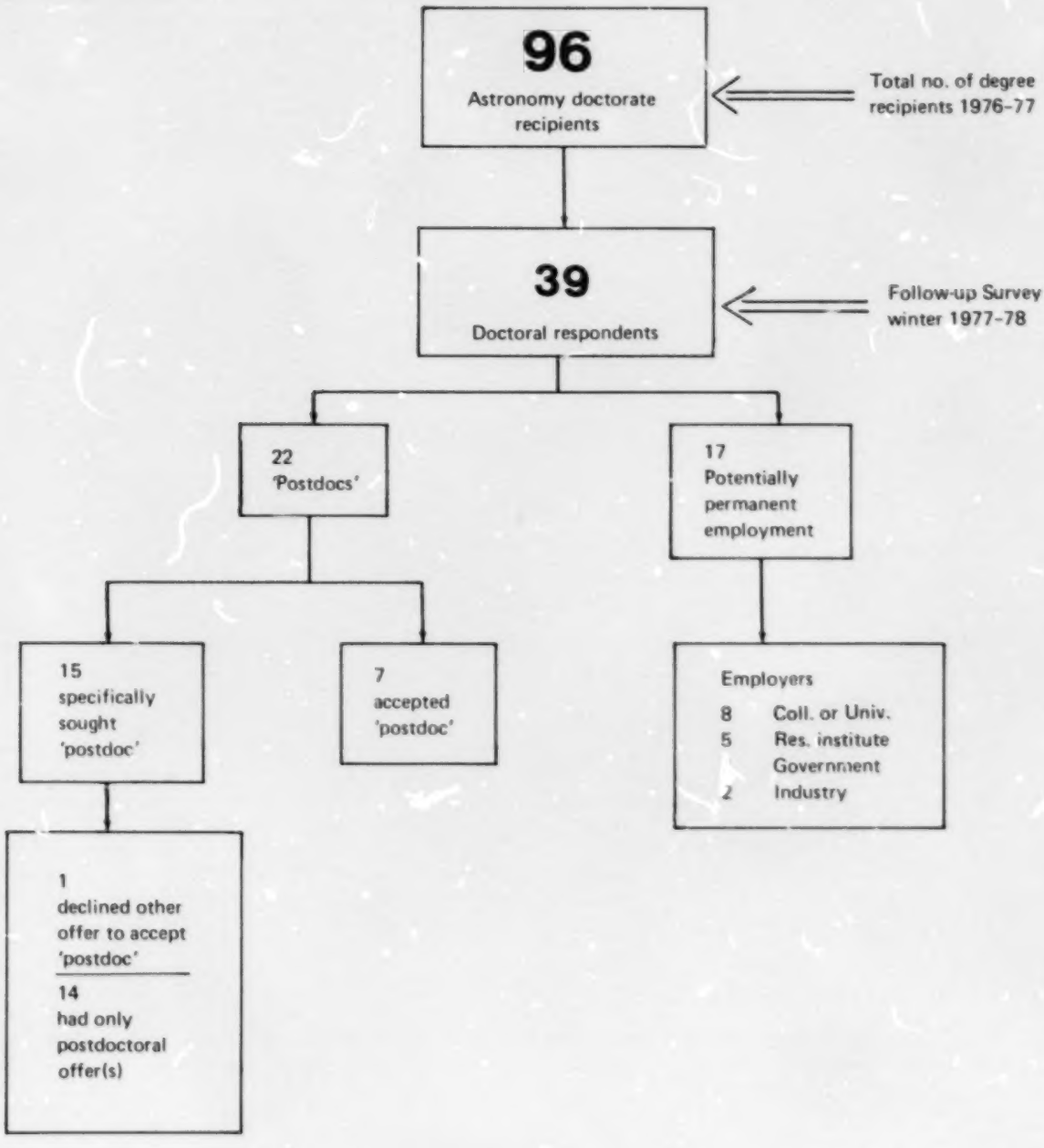
With similar numbers of respondents in two successive years **Table VII** indicates a higher percentage of physicists engaged in physics-related work than the year before. Also industrial employment shows a 10. percentage-point increase from the year before when only 36% of a similar group reported potentially permanent employment in industry. The distribution of work activities presented in **Table VII** did not change appreciably from the previous year.

Since the employer and work activity generally associated with a 'postdoc' are the university and research, **Table VIII** focuses on the length of those fellowships and their relationships to different characteristics of the physicist who accepted it. Thus **Table VIII** shows a slight tendency for women and foreign graduates to be offered shorter 'postdocs'. Also, the majority of graduates who specifically seek a 'postdoc' get one for 18 months or longer.

Table VIII. Factors influencing the length of postdoctoral fellowships for 1976–77 doctoral level physicists.

Characteristics		Length of 'postdoc'			Total	
		< 1 yr.	1.5 to 2 yrs.	> 2 yrs.	%	N
Sex	Men	41%	52%	7%	100%	172
	Women	50	50	–	100	10
Citizenship	U.S.	40%	53%	7%	100%	151
	Foreign	48	44	8	100	31
Subfield of PhD	Elem. particles	28%	59%	13%	100%	34
	Nuclear physics	31	69	–	100	22
	Electron, atomic & molecular	48	52	–	100	25
	Solid state	47	48	5	100	47
	Other subfields	43	48	9	100	54
Specifically sought 'postdoc'	yes	33%	56%	11%	100%	118
	no	61	39	–	100	64
TOTAL	N	76	95	11		182
	%	42	52	6	100%	

Fig. III. Employment status of 1976–77 doctoral astronomers 6–18 months after graduation



Comments from the astronomy PhD recipients refer to the limited opportunities for a career in astronomical research despite the small number of graduates in that discipline. Recommendations to science-oriented undergraduates by these new astronomers invariably include the acquisition of some marketable skills such as applied physics or computer science before concentrating on an astronomy career.